SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

A SCIENCE SERVICE PUBLICATION

$5 a Year 15c a Copy April 5, 1930

SPARROW-SIZE KINGFISHER

A Minnow Is the Largest Fish He Can Catch

(*See page* 221)

Vol. XVII *No. 469*

Islets Are Peaks on Submerged Ridge

Geology

Mid-Atlantic Rocks Upset Popular Geological Theory

FOUR tiny islets in the middle of the Atlantic Ocean, the largest of them only an eighth of a mile across, bear heavy evidence against the validity of the Wegener hypothesis of the westward drift of the American continents, which has proved very attractive to many geologists. Dr. Henry S. Washington, of the Carnegie Institution, discusses the significance of these rocks, and especially their bearing on the problem of the origin of the long submarine ridge of which they are a part, in the first issue of the Journal of the Maryland Academy of Sciences.

The islets are known as St. Paul's Rocks, and they stand up alone in the midst of the South Atlantic, almost midway on the shortest line that can be drawn between Africa and South America. But although the highest point on them is only 64 feet above high-tide mark, the islands are lofty mountain-tops. For they are a part of a 9,000-mile-long submarine mountain range, or ridge on the ocean bottom, that extends through the middle of the Atlantic Ocean throughout almost its entire length, and rises in places as much as 18,000 or 20,000 feet above the bottoms of adjacent deeps. Other peaks that raise their heads above the surface of the sea form the islands and island groups of the Azores, Ascension, Tristan da Cunha, St. Helena, Gough, and Bouvet. Of these, all except St. Helena lie directly on top of the ridge.

The course of the ridge is most peculiar and suggestive. It holds very closely to mid-Atlantic throughout, running almost directly north and south in the South Atlantic, swinging northwesterly to parallel the coasts of South America and western Africa, then north and northeasterly in the North Atlantic. In general, it runs parallel with the continental land lines through its whole length.

Geologists have long puzzled over why this ridge should exist and why it should follow the course it does. Two completely opposite theories have been advanced; one, that it represents the edge of a rift in the earth's crust caused by the pulling apart of the eastern and western continents; the other, that it is due to the squeezing together of the crust under the ocean basin, causing it to hump up.

The rocks of the little mid-oceanic islets furnish the clue. All the other islands located on the ridge are volcanic, and their lavas tell little, because they are melted rock, coming from unknown depths and resulting from imperfectly known physical and chemical processes. But the stone that forms St. Paul's Rocks is not a lava but part of the deep crust of the earth, like the granite of our older mountains on land, though even more massive and heavy, and different in its chemical composition. The group of St. Paul's rocks is the only place on the whole course of the ridge where the real crustal stuff from under the ocean bottom comes to the surface.

Dr. Washington finds that this massive rock shows signs of having been subjected to tremendous squeezing pressures, such as could have come only from sidewise thrusts humping up the ridge between them, and not from a tensional effect resulting from the pulling apart of the continents.

Science News-Letter, April 5, 1930

Monkeys

A monkey can tell the difference between colors, at least when he has been taught that one color means dinner-time and another doesn't. It has, of course, always been assumed that monkeys knew colors, but there was no real proof that they were not color-blind.

The test that proved the color sense was carried out by Prof. W. Trendelenburg of the Berlin Psychological Institute. He put pieces of apple in a box in the monkey's cage. When the box was filled he illuminated it with yellow light; when it was empty he used light of other colors. The monkey finally came to know that yellow signaled "food" and that other colors meant "no food." Consequently when other colors were flashed on the box, even though it contained pieces of apple, the animal paid no attention to it.

The critical test came when a color shade approximating yellow was thrown on the box. Then the monkey appeared to be restless, unable to make up its mind just what it should do.

Animal Psychology
Science News-Letter, April 5, 1930

The Answer Is

In This Issue

What are two conflicting *theories* to account for the sub-Atlantic *mountain* range? p. 210—What is the *height* of the submarine *peaks?* p. 210—Can a *monkey* distinguish *colors?* p. 210—How soon will the number of *births* equal *deaths* in the U. S.? p. 211—How can *photography* aid in the prevention of *cancer?* p. 212—Where are *scientists* looking for the secret of *long life?* p. 212—What is the *beginning* of human *life?* p. 213—What is the basis of fictional "anti-gravity" *jumping belts?* p. 214—How much blood does the normal *heart* pump out in a minute? p. 216—What new *metal* "sandwich" may revolutionize *television?* p. 216—What is *waste* worth? p. 217—How *broad* is our system of *stars?* p. 221—When does the cottonwood tree not shed cotton? p. 221—Where will the total *eclipse* be visible this month? p. 222.

SCIENCE NEWS-LETTER, The Weekly Summary of Current Science. Published by Science Service, Inc., the Institution for the Popularization of Science organized under the auspices of the National Academy of Sciences, the National Research Council and the American Association for the Advancement of Science.

Edited by Watson Davis.

Publication Office, 1918 Harford Ave., Baltimore, Md. Editorial and Executive Office, 21st and B Sts., N. W., Washington, D. C. Address all communications to Washington, D. C. Cable address: Scienserve, Washington.

Entered as second class matter October 1, 1926, at the postoffice at Baltimore, Md., under the act of March 3, 1879. Established in mimeographed form March 13, 1922. Title registered as trade-mark, U. S. Patent Office.

Subscription rate—$5.00 a year postpaid. 15 cents a copy. Ten or more copies to same address, 5 cents a copy. Special reduced subscription rates are available to members of the American Association for the Advancement of Science.

In requesting change of address, please give old as well as new address.

Advertising rates furnished on application.

More Old People; Fewer Children

So Dr. Thompson Sees America in Thirty or Forty Years

Sociology—Economics

Dr. Warren S. Thompson, who is director of the Scripps Foundation for Research in Population Problems at Miami University, Oxford, Ohio, inaugurated a new series of radio talks presented by Science Service over the Columbia Broadcasting System, to be given every Friday afternoon at 3:45. Here is Dr. Thompson's talk in full.

By Warren S. Thompson

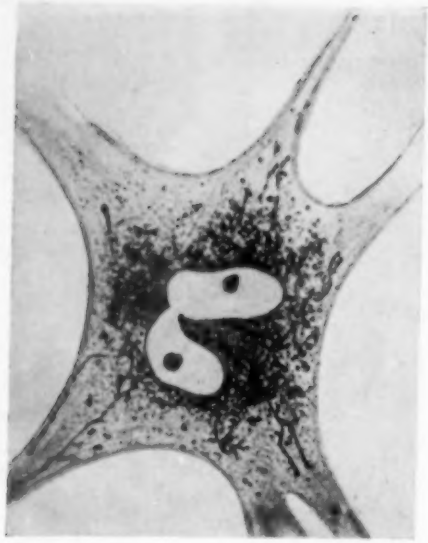
THE United States has entered upon a new era of population growth since the war. Not only is immigration being regulated more strictly than ever before so that we now get but about one-quarter or one-fifth the net annual immigration of the decade before the war but the birth rate has fallen to levels which certainly were not anticipated a few years ago. In 1928 the crude rate of natural increase was only about seven per thousand per year, which is just about one-half of what it was in 1913.

But this is not all, for the crude rate does not give us a very clear notion of what is likely to happen during the next twenty or thirty years. We now have a population so constructed as regards the proportion of people at different ages that it should have a relatively high birth rate and a low death rate, i. e., we have a relatively large proportion of young adults. When the children who have been born since the war reach the age to raise families they will be relatively fewer than those now in the reproductive ages and the birth rate will decline still further even though every mother has as many children as at present. Also the death rate will be higher because we shall have more old people. The statisticians of the Metropolitan Life Insurance Company have calculated the true rate of increase today at about 2.3 per thousand per year which is only about one-third of the crude rate. Calculations made by the Scripps Foundation on a somewhat different basis give an even lower rate. We may, therefore, look forward to a time, possibly not more than thirty or forty years hence, when the number of births in this country will only equal the number of deaths and there will be no natural increase. At this time our total population will probably not exceed 160,000,000, if, indeed, it is that large; it will be only about one-third greater than at present.

When that time comes we shall be quite a different people in certain respects from what we now are. In particular we shall have proportionally fewer children and young people under twenty, and more older people over fifty. Children will be relatively about three-fourths as numerous as now and old people will be nearly twice as numerous. It will be as though we took about one-fourth of our children today and by some hocus pocus transmuted them instantaneously into men and women who had passed their fiftieth year.

Now it is very clear that such changes in our population and its rate of increase as I have just indicated, cannot take place without necessitating very profound adjustments to them on the part of most of our social and economic institutions. If the total number of children born this year is fewer than the number born in 1920 our elementary school population a few years hence may actually be smaller than it is today. Obviously our school plant and our whole educational system is going to have a chance to catch up with the needs in the education of youth which it has never yet had. But just as obviously we are going to have a more difficult problem of adult education to meet than we have had hitherto. For we are hearing a great deal today about the difficulties older men and women are having in securing employment because they lack the ability to adapt themselves to changing industrial processes and commercial practices. The re-education of older people so that they can carry on in their present jobs or in the new types of jobs that are being created, is already becoming a serious matter and when we have about doubled our present number of older people it will become one of the most serious problems of our civilization. It would also appear that many of our businesses which now refuse to hire older workers will have to adopt new employment policies. They will have to take their share of workers who have begun to slow up a little and who have not the highest degree of adaptability, or they will have to pay a large premium for the younger workers who are speedier and more adaptable. It may well happen that the more socially minded employers will undertake to give their older employees a training in new methods and processes so that they can continue with the firm even though the nature of the work they must do has been considerably changed. But we cannot count on this adjustment taking place automatically and must prepare for a very marked increase in old age dependency unless the community as a whole organizes to make effective use of the lessened productive power of our older people.

Conversely the same amount of effort spent on child welfare thirty years hence as is being expended today should come nearer meeting the physical needs of the child than we are now doing. It may even be that some of our children's homes can be converted into homes for the aged. This will not (*Turn to page* 219)



Living Cells Enact In Motion Pictures the Drama of Life and Death

Physiology—Photography

A remarkably clear micro-photograph of a cell from a chick embryo, showing a dividing nucleus, granules of cytoplasm.

By Jane Stafford

MOVIES of the fundamentals of life itself, microscopic dramas of living cells, flash upon the screen in a Baltimore laboratory. It is an endless, unfinished scenario of tragedy and conflict among the smallest of living organisms, the living single cells and their products that make up your body and the bodies of all other animals.

There on the motion picture screen are enacted the existences of all-controlling bits of protoplasm. There may be seen the terrific drama of conflict between life and death engaged in by the millions of cells of your own body during each fleeting moment of your existence.

No movie director engaged in entertaining the pleasure-loving millions is Dr. Warren H. Lewis, the friendly grey-haired exhibitor who has applied motion picture photography to the living world of sizes below the range of the unaided eye. For he is a cytologist who, with his colleagues of the Department of Embryology of the Carnegie Institution of Washington, is engaged in a life-long study of the beginnings and vicissitudes of life.

The cell contains the secret of the cancer and other medical enigma. To advance human knowledge of bodily growth in health and disease, Dr. Lewis has developed a special motion picture camera for microscopic cell photography.

One of the greatest achievements to date has been the photographing, with the cooperation of Dr. P. W. Gregory, of the dividing mammalian egg cell, with its numerous granules and food globules portrayed in the gelatine and silver of the film as they have never been recorded before.

With the aid of these films of cell activity and by other means Dr. Lewis and his associates hope that some day they will have learned all the secrets of the cancer cell and will know enough about it to be able to cure and to prevent this dreaded disease.

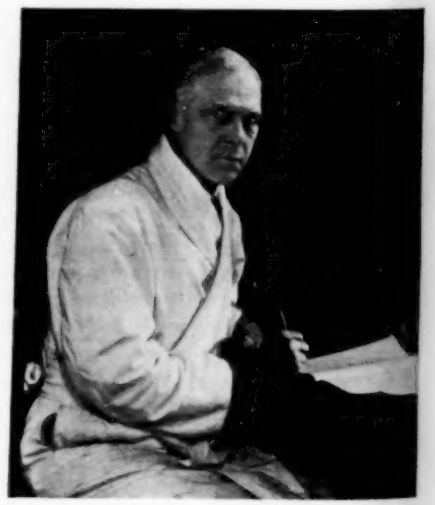
Cancer cells start out in life like other normal cells, but irritations, possibly, or some other cause modifies them so that their multiplication becomes uncontrolled. They run wild, invading tissues made of normal cell, and causing disease of various parts of the body.

To get at the cause of this change in the cells, thousands of them will be observed on the screen. Normal cells and tumor cells will be studied, until the scientists know every faintest motion characteristic of normal cells and just how the motions of the cancer cells differ from the normal. Cells multiply by division of various kinds. The way in which the nucleus and other parts of the cell are arranged just before the cell divides may disclose the factor that starts normal cells on the abnormal path that ends in cancer. Thus the living cells as they move across the motion picture screen are expected to reveal their own secrets.

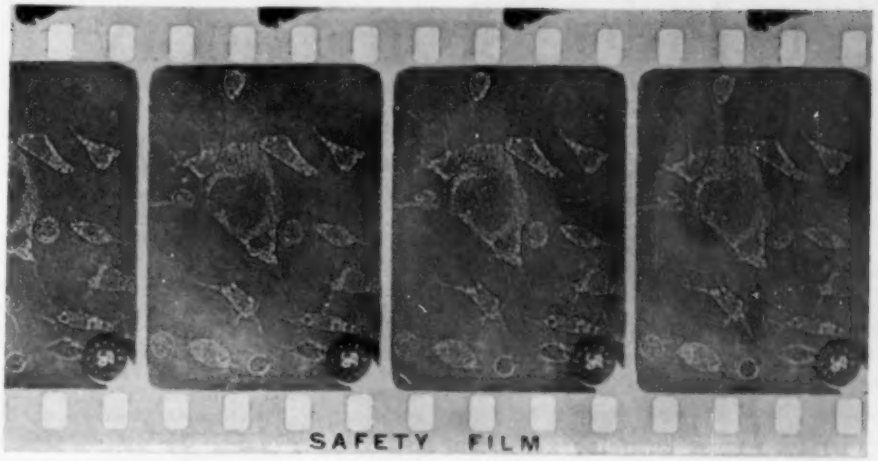
Meanwhile, the scientists at the department of embryology of the Carnegie Institution, under the direction of Dr. G. L. Streeter, hope to learn other vital facts from their study of the cells. One of them is the secret of longevity.

Men no longer expect to find a miraculous Fountain of Youth, but they would like to live out their allotted three score and ten years in health and vigor. Science is trying to lengthen and broaden human life by overcoming disease and by improving human dietary and other habits. These efforts have undoubtedly added years to the length of man's life. However, the secret of a long healthy life is not to be found in a particular brand of cigar, or in abstinence from alcohol or tobacco or meat, nor in any of the various health fads.

About 74 of every 1,000 infants that are born die during their first year of life. About half as many more fail to be born alive. Yet at 89 years Oliver Wendell Holmes is fulfilling the arduous duties of Justice of the U. S. Supreme Court and Elihu Root is active and healthy at 85 years. Many children never reach maturity. Many grown people



Dr. Warren H. Lewis of the department of embryology, who devised the new moving picture camera by which cell movements are being studed.



A strip of film showing a tumor cell and blood cells.

who lead temperate lives succumb to disease in the prime of life and die an untimely death. Others of us, exposed to the same diseases and conditions of life, perhaps far more careless about our health, live out our allotted life spans in vigor and health.

The explanation is to be found in the single cell from which each human being develops, Dr. Streeter said.

Each of us starts from a single, microscopic cell, the fertilized ovum or egg. But in each of these tiny living organisms is contained the germ of every part of the complex organism that is a human being. Every structure of the body and every organ develops from this one small cell. To the untrained, those cells may look exactly the same, but in reality no two are alike, any more than any two human beings are alike. It is precisely the differences in these single cells that the Carnegie Institution scientists are studying now, using the moving picture apparatus to help them, because in the difference in these cells is the reason for the difference in vitality and resistance to disease found in human beings. It is probably the vitality of the egg cell that determines the length of the individual's life.

For example, while disease of the heart and blood vessels is the leading cause of death today, the material from which heart and blood vessels develop is present in the single egg cell. If the egg cell is not perfect in this respect, the heart and blood vessels will probably not be able to stand the strain of life and will break down, resulting in the individual's untimely death from heart disease.

Sometimes these egg cells are so imperfect or so lacking in vitality that the baby does not survive the first year of life. Others do not mature fully. Even under normal conditions, one out of every five of the egg cells is lost. When conditions are not normal, the proportion rises till four out of five or even all the egg cells are lost, that is, fail to develop into living infants.

Resistance to infections, or germs, is known to vary considerably in different people. This resistance, or lack of it, probably started in the single cell from which each person developed. It is largely a hereditary feature, as are the color of the eyes, skin and hair, and the general body stature. Resistance to disease is doubtless a matter of chromosomes and scientists hope to learn more about the chromosomes as a result of studies of cell movements.

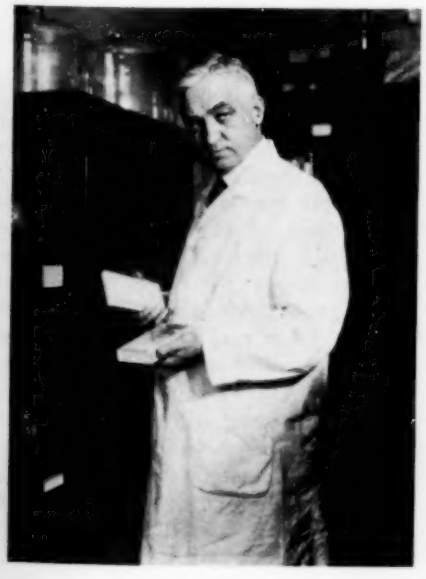
Observation of those cells may reveal the reasons why some develop into healthy infants and others do not. The scientists have already studied thousands of embryos in different stages of development. They have found that every one is different. They are trying to determine just when and how the various organs and parts of the body develop from the egg cell, both normally and abnormally. In this embryology laboratory there is a collection of human embryos in nearly all the different stages of development, from the age of 8 days up. The 8-day one is the youngest human embryo ever obtained. Records of all the available information about each one are carefully kept in the files of the laboratory.

The study has progressed to the point where the scientists can examine an embryo or fetus and state that even if it had developed into a living child, its heart or kidneys would not have been perfect, or it would have been deformed or crippled in some way; or for some reason it could not have lived long. Death before birth was Nature's way of avoiding an imperfect creation.

But there is a gap between the single cell and the 8-day human embryo. In those significant 8-days much has already taken place which scientists need to know. The gap has been filled by the study of rabbits' or pigs' or other mammalian eggs.

The movements of a cell are often too slow to be detected by the eye. Anyone who has looked at objects through a microscope for even a few minutes knows how tedious it quickly becomes. It is easy to see that the job of watching a single cell for many hours would involve a tremendous strain, even if one could thereby see its movements. But such slow movements really cannot be seen directly, but must be speeded up in order to be detected by the human eye. This is what Dr. Lewis' camera does.

The movements of the cells have only just begun to be studied, although scientists have been studying cells for years, and learned their shapes and relative (*Turn to page* 220)



Dr. George L. Streeter, director of the department of embryology of the Carnegie Institution, holding the box of microscope slides on which are preserved sections of the famous Miller Ovum, the earliest-stage human embryo so far discovered. It is kept at the Johns Hopkins University in Baltimore.

The Phlogiston Theory —A Classic of Science

Chemistry

THE DISCOVERY OF OXYGEN, Part 2. Experiments by Carl Wilhelm Scheele (1777). *Published by the Alembic Club* (*Reprint No.* 8). *Edinburgh*: 1901.

One hundred and fifty years ago, fire was one of the unsolved mysteries of science. Watching its consuming action in their fireplaces, people naturally concluded that it is the escape of some light, gaseous substance. This substance Scheele named "phlogiston." Later, experimenting with simpler substances, the chemists found that metals increase in weight on being burnt. This raised the question as to how the escape of phlogiston increased weight, and many men of science adopted the absurdity, which Scheele rejected, of endowing phlogiston with "negative gravity." The concept is still a boon to authors of pseudo-scientific fiction, but proved a serious handicap to chemistry until Lavoisier's clear thinking swept out the theorizing and solved the problem by experiment. Scheele is here seen to be a true experimentalist, also, but his followers, taking his half-finished work as authority, ran into the pitfall that always awaits arm-chair scientists.

7. General properties of ordinary air.

(1.) Fire must burn for a certain time in a given quantity of air. (2.) If, so far as can be seen, this fire does not produce during combustion any fluid resembling air, then, after the fire has gone out of itself, the quantity of air must be diminished between a third and a fourth part. (3.) It must not unite with common water. (4.) All kinds of animals must live for a certain time in a confined quantity of air. (5.) Seeds, as for example peas, in a given quantity of similarly confined air, must strike roots and attain a certain height with the aid of some water and of a moderate heat.

Consequently, when I have a fluid resembling air in its external appearance, and find that it has not the properties mentioned, even when only one of them is wanting, I feel convinced that it is not ordinary air.

8. Air must be composed of elastic fluids of two kinds.

First Experiment.—I dissolved one ounce of alkaline liver of sulphur in eight ounces of water; I poured 4 ounces of this solution into an empty bottle capable of holding 24 ounces of water, and closed it most securely with a cork; I then inverted the bottle and placed the neck in a small vessel with water; in this position I allowed it to stand for 14 days. During this time the solution had lost a part of its red colour and had also deposited some sulphur: afterwards I took the bottle and held it in the same position in a larger vessel with water, so that the mouth was under and the bottom above the water-level, and withdrew the cork under the water; immediately water rose with violence into the bottle. I closed the bottle again, removed it from the water, and weighed the fluid which it contained. There were 10 ounces. After substracting from this the 4 ounces of solution of sulphur there remain 6 ounces, consequently it is apparent from this experiment that of 20 parts of air 6 parts have been lost in 14 days.

9. Second Experiment.—(a.) I repeated the preceding experiment with the same quantity of liver of sulphur, but with this difference that I only allowed the bottle to stand a week, tightly closed. I then found that of 20 parts of air only 4 had been lost. (*b.*) On another occasion I allowed the very same bottle to stand 4 months; the solution still possessed a somewhat dark yellow colour. But no more air had been lost than in the first experiment, that is to say 6 parts.

10. Third Experiment.—I mixed 2 ounces of caustic ley, which was prepared from alkali of tartar and unslaked lime and did not precipitate lime water, with half an ounce of the preceding solution of sulphur which likewise did not precipitate lime water. This mixture had a yellow colour. I poured it into the same bottle, and after this had stood 14 days, well closed, I found the mixture entirely without colour and also without precipitate. I was enabled to conclude that the air in this bottle had likewise diminished, from the fact that air rushed into the bottle with a hissing sound after I had made a small hole in the cork.

11. Fourth Experiment.—(a.) I took 4 ounces of a solution of sulphur in lime water; I poured this solution into a bottle and closed it tightly. After 14 days the yellow colour had disappeared, and of 20 parts of air 4 parts had been lost. The solution contained no sulphur, but had allowed a precipitate to fall which was chiefly gypsum. (*b.*) Volatile liver of sulphur likewise diminishes the bulk of air. (*c.*) Sulphur, however, and volatile spirit of sulphur, undergo no alteration in it.

12. Fifth Experiment.—I hung up over burning sulphur, linen rags which were dipped in a solution of alkali of tartar. After the alkali was saturated with the volatile acid, I placed the rags in a flask, and closed the mouth most carefully with a wet bladder. After 3 weeks had elapsed I found the bladder strongly pressed down; I inverted the flask, held its mouth in water, and made a hole in the bladder; thereupon water rose with violence into the flask and filled the fourth part.

13. Sixth Experiment.—I collected in a bladder the nitrous air which arises in the dissolution of the metals in nitrous acid, and after I had tied the bladder tightly I laid it in a flask and secured the mouth very carefully with a wet bladder. The nitrous air gradually lost its elasticity, the bladder collapsed, and became yellow as if corroded by *aqua fortis*. After 14 days I made a hole in the bladder tied over the flask, having previously held it, inverted, under water; the water rose rapidly into the flask, and it remained only two-thirds empty.

14. Seventh Experiment.—(a.) I immersed the mouth of a flask in a vessel with oil of turpentine. The oil rose in the flask a few lines every day. After the lapse of 14 days the fourth part of the flask was filled with it; I allowed it to stand for 3 weeks longer, but the oil did not rise higher. All those oils which dry in the air, and become converted into resinous substances, possess this property. Oil of turpentine, however, and linseed oil rise up sooner if the flask is previously rinsed out with a concentrated sharp ley. (*b.*) I poured 2 ounces of colourless and transparent animal oil of Dippel into a bottle and closed it very tightly;

after the expiry of two months the oil was thick and black. I then held the bottle, inverted, under water and drew out the cork; the bottle immediately became one-fourth filled with water.

15. Eighth Experiment.—(a.) I dissolved 2 ounces of vitriol of iron in 32 ounces of water, and precipitated this solution with a caustic ley. After the precipitate had settled, I poured away the clear fluid and put the dark green precipitate of iron so obtained, together with the remaining water, into the before-mentioned bottle (§ 8), and closed it tightly. After 14 days (during which time I shook the bottle frequently), this green calx of iron had acquired the colour of crocus of iron, and of 40 parts of air 12 had been lost. (*b.*) When iron filings are moistened with some water and preserved for a few weeks in a well closed bottle, a portion of the air is likewise lost. (*c.*) The solution of iron in vinegar has the same effect upon air. In this case the vinegar permits the dissolved iron to fall out in the form of a yellow crocus, and becomes completely deprived of this metal. (*d.*) The solution of copper prepared in closed vessels with spirit of salt likewise diminishes air. In none of the foregoing kinds of air can either a candle burn or the smallest spark glow.

16. It is seen from these experiments that phlogiston, the simple inflammable principle, is present in each of them. It is known that the air strongly attracts to itself the inflammable part of substances and deprives them of it: not only this may be seen from the experiments cited, but it is at the same time evident that on the transference of the inflammable substance to the air a considerable part of the air is lost. But that the inflammable substance alone is the cause of this action, is plain from this, that, according to the 10th paragraph, not the least trace of sulphur remains over, since, according to my experiments this colourless ley contains only some vitriolated tartar. The 11th paragraph likewise shews this. But since sulphur alone, and also the volatile spirit of sulphur, have no effect upon the air (§ 11, *c*), it is clear that the decomposition of liver of sulphur takes place according to the laws of double affinity,—that is to say, that the alkalies and lime attract the vitriolic acid, and the air attracts the phlogiston.

It may also be seen from the above experiments, that a given quantity of air can only unite with, and at the same time saturate, a certain quantity of the inflammable substance: this is evident from the 9th paragraph, *letter b*. But whether the phlogiston which was lost by the substances was still present in the air left behind in the bottle, or whether the air which was lost had united and fixed itself with the materials such as liver of sulphur, oils, etc., are questions of importance.

From the first view, it would necessarily follow that the inflammable substance possessed the property of depriving the air of part of its elasticity, and that in consequence of this it becomes more closely compressed by the external air. In order now to help myself out of these uncertainties, I formed the opinion that any such air must be specifically heavier than ordinary air, both on account of its containing phlogiston and also of its greater condensation. But how perplexed was I when I saw that a very thin flask which was filled with this air, and most accurately weighed, not only did not counterpoise an equal quantity of ordinary air, but was even somewhat lighter. I then thought that the latter view might be admissible; but in that case it would necessarily follow also that the lost air could be separated again from the materials employed. None of the experiments cited seemed to me capable of showing this more clearly than that according to the 10th paragraph, because this residuum, as already mentioned, consists of vitriolated tartar and alkali. In order therefore to see whether the lost air had been converted into fixed air, I tried whether the latter shewed itself when some of the caustic ley was poured into lime water; but in vain—no precipitation took place. Indeed, I tried in several ways to obtain the lost air from this alkaline mixture, but as the results were similar to the foregoing, in order to avoid prolixity I shall not cite these experiments. Thus much I see from the experiments mentioned, that the air consists of two fluids, differing from each other, the one of which does not manifest in the least the property of attracting phlogiston, while the other, which composes between the third and the fourth part of the whole mass of the air, is peculiarly disposed to such attraction. But where this latter kind of air has gone to after it has united with the inflammable substance, is a question which must be decided by further experiments, and not by conjectures. . . .

Scheel's Apparatus for Analyzing Air

24. Experiments which prove that air, consisting of two kinds of elastic fluids, can be compounded again after these have been separated from each other by means of phlogiston.

I have already stated in § 16 that I was not able to find again the lost air. One might indeed object, that the lost air still remains in the residual air which can no more unite with phlogiston; for, since I have found that it is lighter than ordinary air, it might be believed that the phlogiston united with this air makes it lighter, as appears to be known already from other experiments. But since phlogiston is a substance, which always presupposes some weight, I much doubt whether such hypothesis has any foundation.

Measuring Heart's Output

Details of a new method for measuring the heart's output of blood were described by Dr. Arthur Grollman of the Johns Hopkins University at a meeting of the American Physiological Society.

Four quarts of blood a minute is about what the heart pumps in normal persons. Of course the amount cannot be measured directly, and various indirect methods are resorted to by physiologists. Dr. Grollman used acetylene gas. Making use of the fact that all the blood pumped by the heart goes through the lungs, he determined with a special apparatus the amount of acetylene gas the lungs took up in a given time. From this he was able to figure the amount of blood going through the lungs in that time, and from this the amount of blood—about four quarts—put out by the heart every minute.

Physiology
Science News-Letter, April 5, 1930

Electricity From Sun

Running motors with electricity from sunlight is one of the possibilities forecast by the invention of a new type of cell that converts light directly into useful quantities of current. It is the invention of Dr. B. Lange, of the Kaiser Wilhelm Institute for Silicate Investigation in Berlin. Previously this has not been possible. The new cell, the essential part of which is a "sandwich" of copper oxide between two layers of metallic copper, one so thin as to be transparent, may also prove a revolutionary improvement in talking movies and television and in many phases of scientific work.

Ordinary photoelectric cells, consisting of a layer of a metal such as potassium inside a glass bulb containing either a vacuum or a small amount of inert gas, can only be operated with an auxiliary source of electric current. When light falls on the potassium layer, electrons are given off. When connected to a battery, or other source of current, the electrons are carried to another metal plate or wire which forms the other electrode. Thus, the flow of the current is regulated by the amount of light falling on the potassium layer.

In Dr. Lange's cell, the light falls on one of the thin copper layers and the electrons are driven off. They pass through the copper oxide layer, which is exceedingly thin, only a few layers of molecules in depth. When they reach the other layer of copper an electric current results. Because of the short distance through which the electrons have to travel, the cell operates without the slightest appreciable lag. The current given off is powerful enough that when a rapidly flickering light shines on the cell, the current can be fed into a loud speaker and a note vibrating at the same rate as the light can be heard.

Other advantages of the copper cell are that it does not show fatigue as does the ordinary type, it can be operated indefinitely without loss of efficiency and it is much more sensitive to the infra-red waves, too long to be visible.

In round numbers, Dr. Lange estimates, his new cell is ten times as efficient as the older types. But by the proper adjustment of the middle layer, and the use, perhaps, of other materials than copper oxide, he foresees the possibility of increasing the efficiency still further and converting light directly into large quantities of electricity. Even as constructed at present, the cell should prove a radical improvement in talking movies and television. It will also, suggests Dr. Lange, be useful as a photometer, to measure light intensity, because the current given off is directly proportional to the light falling on it, over a long range of brightness.

Electricity
Science News-Letter, April 5, 1930

Indian Writings Saved

Picture writings left on the rocks along the Susquehanna River by early inhabitans of America are to be rescued from a watery grave, so that scientists may study the prehistoric records. The rock pictures are on islands which will be covered by water when the $30,000,000 hydro-electric development at Safe Harbor is constructed.

The enterprise is unusual in that the Pennsylvania Water and Power Company, which is about to change the appearance of the river region so materially, has been concerned with the scientific value of the rocks. The company is cooperating with the State Museum to finance the removal of the unread picture writings. Donald A. Cadzow, assisted by other archaeologists, will supervise the lifting of the stones.

Mr. Cadzow plans to study the pictures, with the idea of comparing them with what is known about the powerful Conestoga and Susquehannock Indian tribes. This may lead to an understanding of some of the symbols cut in the rocks.

"It is believed that the glyphs were pecked into the hard river rock by an unknown tribe long before the Susquehannock and Conestoga tribes came into the region," Mr. Cadzow stated. "Some of the carvings are almost Asiatic in appearance."

Petroglyphs found in the United States have not been very extensively studied, he explained. This is chiefly due to the belief that only the persons who made the pictures or other persons who lived during the prehistoric times possessed the key to them. The pictures in some cases are thought to have been used in connection with magic rites. Other paintings and carvings must have been "road signs" marking trails and water holes.

Archaeology
Science News-Letter, April 5, 1930

IN VARIOUS CIE

Vitamin A Destroyed

New knowledge of the vitamins was disclosed at the meeting of the American Society of Biological Chemists. Destruction of vitamin A by radiothorium was reported by Prof. A. G. Hogan, C. L. Shrewsbury and Gerald F. Breckenridge of the University of Missouri. This vitamin is important for promoting growth and for preventing eye disease. It is found in butter, cheese, eggs, spinach and liver. While the experiment was conducted with radiothorium, the inference is that any radioactive substance would have the same effect on this important vitamin.

Nutrition
Science News-Letter, April 5, 1930

Osborni

Fragments of skull, face-bones, jaw and shoulder-blade, found by Prof. Wilhelm Freudenberg in Ice-Age gravels of the Bammental near Heidelberg, have proved upon piecing together to be the remains of a big ape-like creature with a brain bigger than that of any known anthropoid ape, either living or extinct, says Natural History, a publication of the American Museum of Natural History. The animal has been named by its discoverer *Hemianthropus osborni*, in honor of the seventieth birthday of Dr. Henry Fairfield Osborn, president of the American Museum.

S CIENCE FIELDS

The *Hemianthropus* part of the name is Greek for "half-man." The creature, if an ape, was a highly advanced kind of an ape. Its somewhat gorilline face was uncommonly wide, and its brain is stated to surpass that of the Trinil skull from Java, and to equal in size the brain of Neanderthal man. The Trinil skull, *Pithecanthropus,* is considered to be human by a great many scientists, though some are of the opinion that it belonged to an ape; but Neanderthal man is unquestionably human.

The editor of *Natural History* adds a note that "The question of the validity of *Hemianthropus osborni* as distinct from Heidelberg man remains an open question."

Heidelberg man has been represented to date only by a jawbone found at Mauer near Heidelberg, in sands of the same geologic age as the gravels that have yielded the bones of *Hemianthropus.* It has been regarded as undoubtedly human, though of a very primitive type, characterized chiefly by its exceedingly massive structure and its almost total lack of a chin. The jaw which Prof. Freudenberg found is even more chinless than the classic Mauer specimen. Its lower border resembles that of the Java skull.

Prof. Freudenberg has been a tireless searcher for human and anthropoid remains in the region around Heidelberg. Recently he found a portion of a broken and water-worn arm-bone which he attributes to a fossil gibbon.

Paleontology

Science News-Letter, April 5, 1930

Safer Crossings

The National Conference on Street and Highway Safety, which has been at work gathering information and pondering ways and means of reducing the heavy toll of automobile accidents in this country, will meet in Washington, D. C., late in May by call of the Secretary of Commerce, Robert P. Lamont.

Committees will report on local problems that delay in many communities the hoped for standardization of traffic rules and signals. The safety situation will be discussed by the official delegates from states and municipalities and from interested organizations, and promising and practical solutions will be considered.

Evidence assembled leads the committees to conclude that safety at crossings both in city streets and on highways can be most readily increased by standardized regulations and signals. This would insure motorists and pedestrians knowing definitely what is expected of them and what their rights are. Not only would accidents be less likely to occur, but congestion due to hesitating and confused motorists would be greatly reduced. Obstructions which prevent motorists and pedestrians from gaining a reasonably long and clear view at crossings should be removed whenever practically possible, and other physical hazards should be investigated and remedied, the committees have urged.

The variety of ways of making left turns to which various cities cling continues to be a problem for the conference The inside turn on the green light is now most common, and is recommended in the model ordinance already approved by the conference.

Marking of traffic lanes where streets are wide has been studied and is found to be a useful device. Observers of traffic have discovered that the wider the street the farther away from the curb vehicles tend to travel. This reduces the speed of traffic. Lane marking relieves this condition.

Safety

Science News-Letter, April 5, 1930

The Waste Trade

Even if Americans are wasteful, as is often claimed, they salvage nearly a billion dollars worth of their waste every year. This is according to figures of the U. S. Bureau of Mines on the amount of scrap and secondary metal recovered which, the Bureau says, is increasing every year.

The waste trade industry is concentrating in large units. Even gold and silver is recovered in quantity from jewelry and dental waste. Photographic solutions contain half an ounce of silver to the gallon and 1,000,000 feet of waste movie film yield 800 ounces.

Of the 500,000 tons of secondary copper recovered annually, part comes from 300,000 burned out electric lamps collected by one company. About 40 per cent of the annual supply of tin and lead has been used before.

The iron and steel saved in a year is worth $500,000,000. Other metals salvaged in quantity from scrap, sweepings, skimmings and dross are mercury, zinc, antimony, aluminum and nickel.

Economics

Science News-Letter, April 5, 1930

Life-Saving Extract

The vital hormone of the cortex of the adrenal gland has been obtained in an extract called cortin, Prof. F. A. Hartman and Dr. K. A. Brownell of the University of Buffalo reported to a recent meeting of the American Physiological Society.

The adrenal gland has two parts, one of which, the cortex, is essential to life. When the adrenal cortex is destroyed by disease or accident or removed by operation, the animal or man dies shortly. However, the Buffalo scientists stated that their extract will prolong the lives of animals whose adrenal glands have been removed so that they live from two and one-half to three times as long as untreated animals without adrenals. The extract when properly made is harmless when injected into human beings. It has been given by mouth with beneficial results in some instances. The method of preparing it was briefly described in the report.

Medicine

Science News-Letter, April 5, 1930

Fainter

Wilk's comet, discovered by a Polish astronomer on Friday, March 21, passed the sun on April 2. It will now be visible with a small telescope in the early morning sky for several weeks. However, though its distance from the sun will make it easier to see, it will be diminishing in brightness. Now, it is of the sixth magnitude, just at the limit of naked eye visibility, but it is so close to the sun that it cannot be seen except with a telescope.

These predictions were made by Dr. A. O. Leuschner, professor of astronomy at the University of California, following calculations of the comet's path by two of his students. They have found that the comet was at perihelion, or closest to the sun, on March 28, only half as far from that body as the earth. When discovered it was just a little farther from the earth than the sun, around a hundred million miles away. By April 10, said Dr. Leuschner, it will be only 85 per cent. as bright as it was when discovered.

Astronomy

Science News-Letter, April 5, 1930

New Plan for Unhampered Teaching

Education

Professors Would Rank Colleges on Academic Freedom

AROUSED by encroachments on academic freedom that have occurred in the last few years, professors of universities and colleges are being urged to place in operation a plan that will put teeth in the demands of the American Association of University Professors that teaching be unhampered by social taboos.

The plan proposed by Prof. L. L. Thurstone of the University of Chicago, a member of the association's committee which investigated the recent dismissal of University of Missouri professors in connection with a sex questionnaire, contemplates a list of "accredited" universities and colleges maintained by the association. Freedom of scholarly and scientific inquiry would rank equally with professional competence of the staff and collegiate level of instruction.

If, in the opinion of an investigating committee, academic freedom were curtailed in any institution, the offending college would be removed from the accredited list.

Professors who subsequently join the faculty of an unaccredited college would lose membership not only in the American Association of University Professors but in their professional, scientific and academic societies as well.

Universities would be replaced on the accredited list only when the cause for removal has been corrected. If a professor were dismissed, the university would need to restore him to his former position and pay back salary in full.

Heretofore the university professors have confined themselves to investigating and reporting on violations of academic freedom, in the hope that resulting publicity would correct the situation. In the case of the dismissal and suspension of faculty members of the University of Missouri, a committee consisting of Prof. A. J. Carlson, physiologist of the University of Chicago, Prof. Percy Bordwell, of the University of Iowa, Prof. John H. Gray of American University, Washington, D. C., and Prof. L. L. Thurstone of the University of Chicago, investigated and condemned the action of university authorities as a breach of academic freedom. Other instances have had the attention of association committees.

"In dealing with this problem we must face the fundamental difference between the mores of the society that supports a university and the ideals and objectives of the scientist," said Prof. Thurstone. "The scientist investigates as objectively as possible the phenomena in his field of special interest, and if his inquiries trespass on the mores of the society that supports him, he is in trouble. He has sinned and is regarded as an immoral influence on the young innocents whom he should be guiding into the ways of righteousness. Here logic does not count. If the public abhor evolution as sinful, we shall only make matters worse by starting an argument with them.

"The history of science is repeating itself. The honest inquiries of Galileo about the physical aspects of the universe trespassed on the taboos of his time, so Pope Urban declared that 'it is a question of the most godless business which could ever be discussed—that the doctrine was in the highest degree sinful.' Charles I in France forbade the possession of furnaces and apparatus necessary for chemical processes, and Henry IV did the same in England. A Birmingham mob and an Anglican clergyman wrecked the home of Priestley, destroyed his library and instruments, and drove him into exile. The teachings of Linneus about the sexual system in plants were for many years prohibited in the papal states and elsewhere in Europe. But in 1773 permission was given that they be discussed in Rome.

"The present day conflict between science and superstition is seen in the legislative attempts against evolution and vivisection. The social scientist who inquires about the sex code on which we have built our system of morality finds that he also violates popular taboos. The economist who investigates or lectures about unpopular economic theory or about socialism may find himself in trouble with the trustees and with the 'one-hundred percenters' in society. The historian who aims to discover the truth about our historical heroes may find that the public does not want to have its idols shattered. The scholar who ventures into biological and social phenomena is likely to have trouble with superstition and prejudice."

Science News-Letter, April 5, 1930

America Growing Older—*Continued*

lessen the total amount of dependency but it will change the nature of the problem very markedly. Indeed it seems rather probable that the support of dependents will absorb an increasing share of our national income for some time to come unless we begin to plan ways of making better use of the labor of our older people. The present tendency is certainly all in the direction of discarding the worker as soon as he begins to slow up. It needs no argument to convince any one that our national prosperity will be seriously compromised if we do not find profitable employment for this rapidly increasing group of older workers. Think what it will mean to our economic life to have an increasing proportion of old people who are dependent and whose purchasing power is therefore very low. They would be poor customers, indeed, while what we need if we are to continue to be prosperous in our present system is better customers rather than poorer ones.

We must remember, too, in connection with maintaining our prosperity that in all probability the rate of increase of our population will not be much more than half as great between 1930 and 1940 as it has been this last decade and that in actual numbers the increase of our population will probably be from five to seven millions less than in the decade just completed. It requires no prophet to foresee an increasing intensity of competition in many aspects of our business life. As long as population is growing by leaps and bounds business grows in like manner and customers are not wanting. With the slower increase in the number of customers in the future our business has a new situation to meet. It cannot depend as much as formerly upon mere increase in number of customers. It must begin to plan how it can improve the quality of its customers. It would seem on the face of things that there is but one way to do this. The purchasing power of the mass of the population must be increased. This s h o u l d not be particularly difficult of accomplishment, for such an increase has been going on for several decades, but our economic leaders must give increasing attention to this phase of our economic life in the future if we are not to suffer in our pockets from the slackening growth of population. There is no doubt that the purchases of most people are only limited by their incomes, hence if salaries and wages can be increased sufficiently there will be no difficulty in taking up the slack in purchasing power that may arise from the slower growth of population. Here is a situation which challenges both the good will and the ability of our business leaders.

In closing I would call attention to the probable growth in economic and political conservatism as the average age of our population increases.

American business has been noted for its daring. This aspect of our economic life is very widely noted by foreigners. But daring and progressiveness are the qualities of youth, and of youth with but little property at stake. Will our economic enterprise be as daring and progressive when its actual control passes into the hands of older men who are capitalists and bankers rather than enterprisers and engineers? One cannot say, but to judge from the frequent complaints lodged against the control of industry by older men on the part of young technicians it seems rather probable that an average increase of ten years in the age of men in the key positions in our industrial and commercial life may have a very marked effect upon the adaptability and progressiveness of our whole business structure.

There is also a probability that there will be an increasing conservatism manifest in our political life as a larger proportion of the electors pass into the group of fifty and over. If this should happen it will undoubtedly induce a like increase in various types of radicalism, since it is undoubtedly the relatively good opportunities for young men to rise to a higher economic status which have prevented the formation of strong radical groups in this country in the past. Radicalism is the natural response of youth to increasing economic and political conservatism.

Finally I wish to say that the changes which are now taking place in the rate of growth and the make-up of our population are among the most fundamental social changes of our day and it behooves all of us, but particularly business men, to keep close tab on them.

Science News-Letter, April 5, 1930

Motion Pictures Of Living Cells—*Continued*

sizes and the changes they undergo in multiplication and during the life of the animal and during disease processes. Studies of cells have been made with the aid of powerful microscopes which magnify the tiny organisms that would be too small to be seen with the naked eye. Now comes the moving picture camera with a quick-motion device that makes it possible to see the movements of the cells readily. As a result new and unsuspected facts about cells have been discovered.

For instance, it has been found that certain cells of the blood which act as scavenger cells, change their shapes when they get into the tissues. In the blood stream they are round and of fairly uniform size, but in the tissues they spread out into every conceivable shape and wave long veil-like appendages or branches about in all directions, gathering in globules of liquid, fragments of cells and proably other foreign particles.

These scavenger cells, which are called monocytes, rush to the site of a bruise, or a black and blue spot, and clean up the mess. After they have gotten filled up with dozens of red blood cells and other debris they become many times larger than they were and are usually called macrophages. The macrophages are grown-up monocytes. The change in size is very striking. The monocyte may take in as many as 50 cells the size of its own self.

These monocytes are also found together with cancer cells, but the monocytes are much more active than the malignant cells. In fact, the moving pictures have shown that the blood cells are the most active of all the cells. On the screen this is very clear. The monocytes or macrophages are seen to wave their veils and move rapidly about, but the tumor cells move very much slower.

The apparatus with which Dr. Lewis takes his pictures of living cells consists essentially of a microscope, a motion picture camera and a timing device. The cells themselves are on a slide under the microscope. A light reflected by a mirror illuminates the field. The chamber containing the microscope and specimen is kept at the uniform temperature best suited to cell life and activity. The camera is mounted above the microscope with a thin cover glass placed between at an angle of 45 degrees. This allows 95 per cent. of the light to pass through to the exposed film of the camera, while 5 per cent. of the light is deflected to an observing eyepiece through which Dr. Lewis or his associates can observe directly the material under the microscope while pictures of it are being taken.

The timing device consists of a series of interchangeable pulleys driven by a constant speed motor. This device regulates the number of exposures per minute, which can be varied from 1 to 60.

The image of a watch projected into one corner of the film enables the observers to determine the time at which various events occur when the film is projected onto the screen at the normal rate of 960 pictures per minute. It really times the cell movements. Watching the films, Dr. Lewis can see that a particular cell he is observing started dividing at 10 o'clock and is through dividing at, say 10:30.

A strip of test film is taken and developed first. When this test shows that the time of exposure is correct, the camera is allowed to run hours, even all night if necessary.

The outlines of the living cells seen on the motion picture screen are not so sharp as those of fixed and stained cells when viewed on a slide under the microscope. The activity, however, has shown many things that were not seen before. The scientists are in the position of a man who is looking across a field and sees no sign of life until suddenly some bird or animal moves. Even then he may not clearly see the outlines of the animal, seeing chiefly the motion, but the motion reveals the presence of the animal and probably its kind. So to the scientists the quickened motion of the cells shows many things that they had not seen before in the field they observed through the microscope.

One of the things that has been seen most clearly with the aid of the cell movies is the waving veils of the monocytes. Another is the fact that the nucleus of the cell rotates, sometimes as much as 180 degrees, without disturbing the cytoplasm, which surrounds the nucleus and is intimately connected with it. The significance of this new discovery is not yet clearly understood, but it is one of the many new facts about cells which are being learned with the aid of the motion picture. Probably it has some relation to cell division.

This division is one of the most fundamental things in all life, because the way in which cells divide regulates the way in which organisms grow and develop. Also, cell division has a vital bearing on the concer problem. In this condition there is greatly increased cell multiplication, hence increased cell division. Possibly the manner of division is changed as well as the rate.

Another of the things that the cell movies have shown is the great activity of the chromosomes in going from the prophase to the metaphase. These are respectively the first and second broad stages of cell division. In the metaphase the chromosomes split longitudinally into exactly similar halves. In the prophase a preliminary arrangement of the chromosomes takes place. The amount of chromosome activity accompanying the changes was viewed on the motion picture screen.

We do not yet know much about cell division. It needs much more study to determine its why and how. However, each new fact discovered, each bit of information gathered from such investigations as are being made at the Carnegie Institution's embryology laboratory add to our knowledge of the fundamentals of life itself.

NATURE RAMBLINGS

By Frank Thone

Cottonwood

A much maligned tree that would, if given a fair chance, be very useful for shade and ornament is the American poplar, or cottonwood. Quick of growth, exceedingly hardy, readily adaptable, it is in its natural state a "pioneer," appearing at the edges of things, where conditions are still unfavorable for other trees; marching out into the western dry plains, where hardly any other trees can grow at all.

Two objections are advanced against the cottonwood. One is that it becomes irregular and awkward in shape as it becomes old, the other that it "sheds cotton" all over everything. The first objection is not serious if the tree is regarded, as it should be, primarily as a tree for temporary planting, to be removed when the more permanent trees have reached their maturity.

The objection to the cottony seeds is more serious, but very easily overcome. Unlike most smaller plants, but like many other trees, the cottonwood genus is bi-sexual, that is, the pollen-bearing flowers are borne on one tree and the seed-bearing flowers on another, and it is only the seed-bearing tree that scatters the "cotton." The one offense of the pollen-bearing tree is that it litters up the sidewalks, for a short time in spring, with the finger-length red catkins of spent staminate flowers, that look like vegetable caterpillars; but this is nothing serious. If therefore one only takes care that nothing but pollen-bearing trees are planted, there will never be any "cotton" to contend with.

It is very easy to secure a pure stand of pollen-bearing trees. Seedlings should never be used, for no one can tell how a seedling will turn out until it is full-grown. The proper thing to do is to grow the young trees from cuttings taken from trees known to be pollen-bearing, for the new trees will of course always remain of the same sort as the original stock.

Science News-Letter, April 5, 1930

Our Universe Part of "Super-Universe"

Astronomy

WE live in a "super-universe." The sun, the Milky Way, all the stars we see in the night sky, even when looking through a large telescope, form a huge system made by the condensation of a loose swarm of smaller clusters of stars. One of this system's component clusters is the globe of stars between thirty and sixty quadrillion miles in diameter, in which our sun is an insignificant member.

Such is the latest picture of the structure of the cosmos, delineated by Dr. Harlow Shapley, director of the Harvard College Observatory, in a Harvard Observatory circular just released.

A few years ago, Dr. Edwin P. Hubble, of the Mt. Wilson Observatory, solved the mystery of the spiral nebulae by showing them to be swarms of stars something like our own "universe", or galaxy, but probably outside its limits. Further studies brought fresh evidence for this theory, but also showed that our galaxy was far larger than any of the spirals. Dr. Shapley's new theory, based on a study of several independent swarms of spirals, perhaps similar to that from which our galaxy has evolved, removes the difficulties. The individual clusters in our system, and not the entire system itself, are shown to be analogous to the outside spiral nebulae.

"Our galactic system, it is now proposed, is neither an uncommonly great spiral, nor a single unified star system like a Magellanic Cloud on a grand scale," he said, "rather it is a super-galaxy—a flattened system of typical galaxies. In mass and population the galactic system should therefore be compared with the Coma-Virgo cloud of bright galaxies, which is composed of some three hundred members.

"Our local system, a star cloud a few thousand light years in diameter, appears to be a galaxy similar to the Clouds of Magellan or to the typical extragalactic nebulae. The Scutum star cloud, the Cygnus star cloud, and perhaps half a dozen other distinct Milky Way clouds also are or have been, on this interpretation, typical galaxies, in the sense in which the average spiral nebula is a galaxy.

"The greater part of the recorded obscuring nebulosity (and of the bright diffuse nebulosity as well) is concentrated near the plane of the local system; on the present view it represents an equatorial dark ring of matter, such as is frequently observed on the edges or between the arms of many spiral nebulae.

"The work at Harvard on the star clouds in and near the galactic center suggests that the Sagittarius-Scorpio-Ophiuchus region is occupied by a single galaxy of about the dimensions and structure of the great Andromeda Nebula. Its size is comparable; its novae also are concentrated towards the center. The central region is so rich in stars that if seen from the distance of the Andromeda Nebula they could hardly be resolved by any existing telescope."

Dr. Shapley concluded:

"We observe that the interpretation of the galactic system as a cloud of ordinary galaxies removes the anomaly of the status of our system in the stellar universe. Ours is not a spiral fifty times the average in diameter, nor an entirely unmatched discoidal star system."

Science News-Letter, April 5, 1930

Sparrow-Size Kingfisher

The Celebes Wood Kingfisher (*Ceycopsis fallax*), shown on the cover of this week's SCIENCE NEWS-LETTER, is a bird scarcely as large as an English Sparrow. Similar kingfishers of tiny dimensions are found in various tropical countries. They are hunters as well as fishers and feed on insects and other life as well as on small minnows. They frequent forests quite as much or more than watercourses.

The picture is supplied through the courtesy of the Field Museum of Natural History.

Ornithology

Science News-Letter, April 5, 1930

The oldest watches known today date from about 1550, but it is believed that watches were invented some 50 years before that.

Elevated playgrounds about 14 feet above street level are proposed for the use of children in New York's crowded tenement districts.

Labor inspectors in Germany have noted a shortage of apprentices in many industries due to the decline in the birth rate during the World War.

400,000 old, unfit automobiles will be scrapped during the coming year in a highway safety drive.

Total Eclipse of Sun Coming Soon

Astronomy

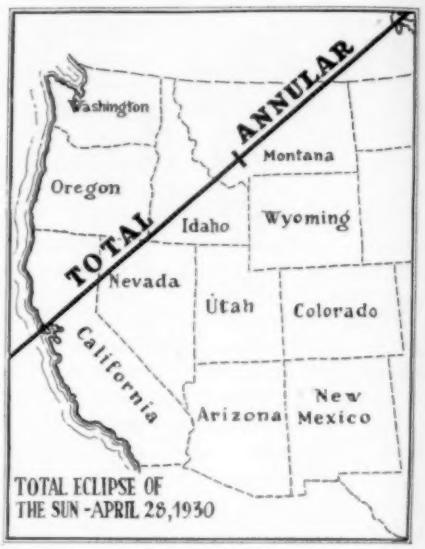
By James Stokley

CHIEF of the astronomical attractions for the month of April, 1930, is the first eclipse of the year. Over a very narrow path crossing the Pacific coast just north of San Francisco Bay, then over California, Nevada, one corner of Oregon, Idaho, and Montana, the shadow of the moon will graze the earth on the morning of Monday, April 28. It will be just a glancing blow that the tip of the shadow will make—quite different from the hearty stroke of the shadow next October, for instance, when a second total solar eclipse will be visible in the south Pacific. But despite the unfavorable conditions, astronomers will journey to points along the path, in California and Nevada, to make the most of the second or so during which the sun will disappear. California is an astronomical center; its astronomers often want money to travel halfway around the earth for an eclipse, and how are they to defend themselves from the charge of junketing if they ignore an eclipse in their own backyard?

In general there are two kinds of solar eclipses. The sun is about 865,000 miles in diameter, compared with 2200 miles for the moon. As a result, the shadow that the moon casts has the shape of a cone, with its base on the side of the moon that is turned from the sun and the tip about 240,000 miles above this side. It so happens that this is the approximate distance between the moon and the earth, a distance which varies slightly. Sometimes the tip of the shadow reaches well beyond us, then the shadow may be a hundred miles or more wide where it touches the surface of the earth. The sun and the earth are both moving, so the shadow sweeps along from west to east, producing the "path of totality" in which the sun's disc is obscured.

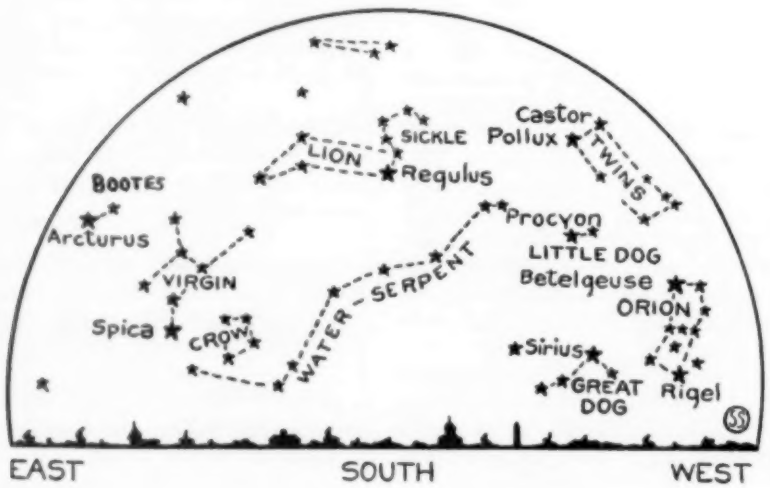
But sometimes the earth and moon are farther apart. Then the tip of the shadow fails to reach the surface, and instead of a "total" eclipse, we have one that is "annular." Because the apparent diameter of the moon is less than that of the sun at the time, the "path of totality" becomes the "path of the annulus" in which a person will see a doughnut-shaped ring of the sun's disc around the black globe of the moon.

This month's eclipse will be both annular and total. The eclipse will start at sunrise out in the middle of the Pacific Ocean. Here the shadow will fail to reach the earth and the eclipse will be annular. The annulus will sweep along to the east. But the earth is round, the tip of the shadow approaches nearer and nearer to the surface, while the bright ring, or annulus, gets narrower and narrower. Finally, just off the Pacific coast, where the earth's surface is several thousand miles closer to the moon than at the place where the eclipse started, the tip of the shadow touches the earth and the eclipse becomes total. Thus it crosses California and other western states, a point in eastern California being the closest to the moon and the place where the eclipse is longest. Even here the shadow will only be about half a mile in diameter, and totality will only last about a second and a half. As the shadow speeds on, its diameter becomes less and less, and finally, about 50 miles east of Butte, Montana, the tip of the shadow leaves the earth. From then on the annulus reappears, passing across Saskatchewan, Manitoba, Hudson Bay, Labrador, and departs from the earth completely at sunset in the middle of the North Atlantic. Such an eclipse, both annular and total, is called a central eclipse.



With an eclipse of such short duration, astronomers will have their difficulties. There will just be time for one brief photograph of the corona, instead of several, with exposures varying from a second or so to some thirty seconds or more. But most difficult of all will be the determination of the exact path of the eclipse. It is perfectly true that astronomers can predict the path of an eclipse a century in advance, and could go to a place where it will be seen, set up their telescopes now, leave them for a hundred years and come back and find only a few minor adjustments necessary. But this is only true of a really favorable eclipse. The exact calculation of the moon's wanderings is one of the most difficult problems of modern astronomy, and at best predictions are merely very close approximations.

A motion of a half mile of the moon's shadow means motion of the moon itself of approximately the same amount. Calculating in advance



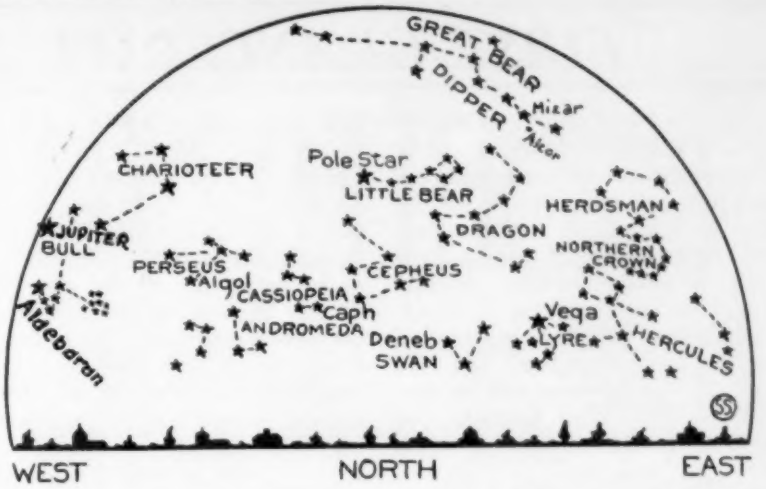
HOLD THESE MAPS in front of you to see the arrangement of the stars in the April evening sky. This one shows the southern sky, the one on the next page shows the stars in the north.

the position within half a mile of a body 2200 miles in diameter and some 240,000 miles away is a very tricky procedure.

With the eclipse path this month only half a mile wide, however, such a difference between the predicted path and what it actually is would mean the difference between being in the path or out of it! For that reason the predictions of this eclipse have probably been carried out with greater precision than ever before. They were completed last month at the Nautical Almanac Office, in Washington, and observations of the moon made as recently as March 12 were used in the computations. Probably no astronomer whose selections of an observation post is guided by these calculations will find himself outside the path completely, though such an outcome is not inconceivable. What may happen is that he may choose a point that he believes to be in the center of the path, and that the real center may be a few hundred yards to the north or south. Then, instead of the eclipse lasting the full second and a half, it may only last a half second and he will get only a fleeting glimpse.

Some astronomical observations will be made from the air. Dr. H. M. Jeffers of the Lick Observatory, will make a flight in a U. S. army airplane. By flying at a high altitude, a very slight advantage can be obtained in the length of the eclipse, and by flying along with the shadow of the moon, there is a further slight advantage. But again there comes up the difficulty of navigation. Even if the path were predicted precisely, it would test the skill of a pilot to fly the plane right along the center line, and with the uncertainties, it is quite likely that a pilot would find himself outside of the path, too late to rectify his error. Recognizing this, the Lick observers plan to make one observation that can be made from outside the path nearly as well as in it. This consists in aerial photographs of the shadow as it sweeps across the earth. Such photographs would give a permanent record of the eclipse path, and provide very accurate means for checking the positions of the moon.

On the ground will be another group from the Lick Observatory, located in Yuba County, about 125 miles northeast of San Francisco, and under the leadership of Dr. J. H. Moore. With him will be Dr. D. H. Menzel. Another ground party will be under the direction of Dr. H. D. Curtis, director of the Allegheny Observatory at Pittsburg and a veteran eclipse observer, who will be on the edge of the Black Rock desert, near Gerlach, Nevada. Near Honey Lake, in eastern California, will be Dr. S. B. Nicholson, from the Mt. Wilson Observatory.



The main observations by these parties will be of the flash spectrum. For an instant just before and just after totality, when only the outermost layer of the sun is visible above the moon, the so-called "reversing layer" can be observed. The ordinary solar spectrum, obtained when its light is analyzed by the prisms of a spectroscope, consists of a colored band crossed by dark lines. These dark lines are produced by absorption of certain colors of sunlight by this reversing layer. When the reversing layer can be observed by itself, however, the spectrum shows bright lines of colors the same as those ordinarily absorbed. From such photographs of the flash spectrum many solar puzzles have been solved. As they can only be made at the beginning and end of an eclipse, the duration is immaterial, though some complication is produced by the fact that the higher parts of the reversing layer will be visible completely around the sun. However, this can probably be corrected by the use of a screen in front of the telescope so that only half of the sun's image enters the lens. Even if one is just out of the path of totality, valuable photographs of the flash spectrum can be made. But to record the corona, the important outer layer of the sun that can only be observed at eclipse time, the camera must actually be in the shadow. To avoid the possibility of missing the corona, the Lick Observatory astronomers will have three cameras, located along a north and south line at intervals of about a third of a mile. Then one will surely succeed.

After this month astronomers will have to wait until October when a much better eclipse, astronomically, will be seen from Niuafou Island, a tiny bit of land in the South Pacific.

In other parts of this country and Canada, the eclipse of April 28 will be visible as partial, the sun appearing as a round cookie from which a bite has been taken. The nearer you are to the path of totality, the larger will be the bite. The approximate times of beginning and end of the partial eclipse are as follows: Eastern States: begins 2:00 p.m. E.S.T., ends 4:30 p.m., E.S.T.; Midwest and Southeastern states: begins 12:30 p.m., C.S.T., ends 3:15 p.m., C.S.T.; Mountain states: begins 11:00 a.m., M.S.T., ends 2:00 p.m. M.S.T.; Pacific states: begins 9:40 a.m., P.S.T., ends 12:30 p.m., P.S.T.

About two weeks before the eclipse of the sun, when the moon is on the other side of the earth, it will partly enter the earth's shadow and so on the night of April 12 there will be a partial eclipse of the moon. At 12:58 a.m. E.S.T., early on the thirteenth, about a ninth of the moon's diameter will be immersed in the shadow, and will appear darker than the rest of the lunar surface.

The planet Jupiter is still to be seen in the April evening sky. It is in Taurus, near Aldebaran, but more brilliant than that star. At the end of the month the seldom-seen planet Mercury will be visible low in the western sky just after sunset. Those who see the total eclipse will probably notice this brilliant planet to the east of the eclipsed sun, as well as Venus. The planet Venus is now coming into the evening sky. It is the brightest of the planets now visible, and can be seen all month in the western sky for an hour or so after sunset.

FIRST GLANCES AT NEW BOOKS

NEW VIEWS OF EVOLUTION—G. P. Conger—*Macmillan* ($2.50). The author presents, in brief, non-technical summary not only an account of the evolution of organisms, but also sections on the evolution of matter from both the cosmogonic and physical angles and on the evolution of mind. The concluding chapters on Some Philosophies of Evolution and An Estimate of Evolutionism will be useful to those who want a history of the question in briefest possible form.

Evolution

Science News-Letter, April 5, 1930

AMERICAN NATURISTS—Henry Chester Tracy—*Dutton* ($3.90). This group of biographical appreciations treats of men and women widely separated in space, time and interests; some of them scientists of the keenest modern type, some naturalists of the old school, some persons of affairs who sought the out-of-doors for recreation or avocation. But they are all united by their compelling interest in, and unflagging enthusiasm for nature, and together they form an apostolate which America must follow if there is to be any health left in us at the end of another couple of generations.

General History

Science News-Letter, April 5, 1930

SURGERY AT THE NEW YORK HOSPITAL ONE HUNDRED YEARS AGO—Eugene H. Pool & Frank J. McGowan—*Hoeber* ($1.50). The book is largely made up of excerpts from the newly discovered "Surgical Register" for the period from 1808 to 1833 of the New York Hospital. It will be amusing and interesting to modern surgeons and physicians.

Surgery

Science News-Letter, April 5, 1930

DRESS AND ADORNMENT IN THE MOUNTAIN PROVINCE OF LUZON, PHILIPPINE ISLANDS—Morice Vanoverbergh—*Cath. Anthropol. Conf.* ($1). A well-illustrated pamphlet treating of one uniting aspect of the life of a group of Philippine tribes.

Anthropology

Science News-Letter, April 5, 1930

REPORT OF THE COMMISSIONER OF FISHERIES, 1928—*U. S. Government Printing Office* ($1.65). A summary of the manifold and far-reaching activities of one of the most important of Government bureaus during the fiscal year 1928.

Fisheries

Science News-Letter, April 5, 1930

SEVEN IRON MEN—Paul de Kruif—*Harcourt, Brace and Company* ($3.20). The author of "Microbe Hunters" tells how the microscopic gallionella brought forth the mighty United States Steel Corporation and in so doing caused the rise and fall of the Merritt family of Minnesota, the seven iron men. It is more than a good story, well told; and, withal, a tragic one. It is an informative cross-section sawed from the growth of big business.

Mining

Science News-Letter, April 5, 1930

ANNUAL REPORT OF THE DIRECTOR, 1929—*Field Museum.* In addition to the customary listings of accessions, receipts, expenditures and the thousand Martha-jobs a museum director has to tell about once a year, this volume offers much information in a score of varied scientific fields, lighted with a number of fine illustrations.

General Science

Science News-Letter, April 5, 1930

THE SHAFT GRAVES AND BEE-HIVE TOMBS OF MYCENAE AND THEIR INTERRELATION—Sir Arthur Evans—*Macmillan* ($6). These two types of ancient royal graves excavated in Mycenae have caused wondering and speculation, and it is of great interest to have the conclusions of so eminent an expert on this matter. Besides explaining his view that the royalties and their precious funeral relics were transferred from the beehive tombs to the safer shaft graves at some time of great emergency, Sir Arthur makes clear the significance of many objects found in the burials and shows relations with Crete.

Archæology

Science News-Letter, April 5, 1930

ANIMAL MICROLOGY—Michael F. Guyer—*University of Chicago Press* ($3). A third edition of a widely used laboratory guide in the preparation, sectioning and staining of animal materials for use under the microscope.

Biology

Science News-Letter, April 5, 1930

CHANGING CIVILIZATIONS IN THE MODERN WORLD—Harold Rugg—*Ginn* ($1.96). A textbook for junior high school which makes interesting reading to the grown-up. It dramatically tells a world story of geography, history and economics.

Sociology

Science News-Letter, April 5, 1930

HUMAN BIOLOGY AND RACIAL WELFARE—27 Contributors, edited by E. V. Cowdry and E. R. Embree—*Hoeber* ($6). Too heavy for the average reader, but the student or layman of some education will welcome this volume as a pleasant relief from the usual popular accounts of science, especially biology. The book contrives to be readable, interesting and non-technical without becoming elementary or reaching the level of entertainment for the tired business man. Various aspects of the subject are presented by specialists in each field. The book is designed for students and a mature public. Incidentally the physical weight of the volume seems excessive for its size.

Biology

Science News-Letter, April 5, 1930

THE CHERRY AND ITS CULTURE—V. R. Gardner—*Orange Judd* ($1.25). A good many cherry trees have been planted in this country since young George Washington first established a reputation for consistent veracity, and their owners usually want to know how to take care of them, how to fight their insect and fungus enemies and how to handle their crop. Whether you own two cherry trees or twenty thousand, this little book will be a useful addition to your gardening shelf.

Horticulture

Science News-Letter, April 5, 1930

RELIABILITY OF FUSIBLE TIN BOILER PLUGS IN SERVICE—John R. Freeman, Jr., J. A. Scherrer and S. J. Rosenberg—*U. S. Government Printing Office* (10c). Ten per cent. of the accident-preventing fusible boiler plugs in marine service do not work, this Research Paper No. 129 of the U. S. Bureau of Standards shows. The tests described were made following a disastrous explosion. Safety measures are recommended.

Mechanical Engineering

Science News-Letter, April 5, 1930

THIS UGLY CIVILIZATION—Ralph Borsodi—*Simon and Schuster* ($3). Blame for the ugliness of our modern world, with its noise, smoke, smells, and crowds, is laid on the factory. The author approves of machinery, however. It appears that he would like to see each home functioning as an independent economic unit, a small, socialized production plant.

Sociology

Science News-Letter, April 5, 1930